
CANCER FACTS

National Cancer Institute • National Institutes of Health

National Cancer Institute Research on Causes of Cancers in Children

Background

Approximately 8,500 children were diagnosed with cancer in 1998, and 1,700 children died from the disease during this year. While this makes cancer the leading cause of death by disease among U.S. children under age 15, cancer is still relatively rare in this age group, with, on average, one to two children developing the disease each year for every 10,000 children in the United States.

Among the 12 major types of childhood cancers, leukemias (blood cell cancers) and brain and other central nervous system tumors account for over one-half of the new cases. About one-third of childhood cancers are leukemias; approximately 2,300 children (younger than 15 years) will be diagnosed with leukemia in 1999. The most common type of leukemia in children is acute lymphocytic leukemia. The most common solid tumors are brain tumors (e.g., gliomas and medulloblastomas), with other solid tumors (e.g., neuroblastoma, Wilms' tumor, rhabdomyosarcoma) being less common.

Over the past 20 years, there has been relatively little change in the incidence of children diagnosed with all forms of cancer; from 13 cases per 100,000 children in 1974 to 13.2 per 100,000 children in 1995. During this same time, however, death rates declined dramatically and survival increased for most childhood cancers. For example, the 5-year survival rates for all childhood cancers combined increased from 55.6 percent in 1974–1976 to 73.8 percent in

1989–1994. This improvement in survival rates is due to the significant advances in treatment, resulting in cure or long-term remission for a substantial proportion of children with cancer.

Long-term trends in incidence for leukemias and brain tumors, the most common childhood cancers, show a somewhat different pattern than the others. Childhood leukemias appeared to increase in incidence in the early 1980s, with rates in the preceding years being somewhat less than four cases per 100,000 and with rates in the succeeding years being relatively stable at slightly over four cases per 100,000.

For childhood brain tumors, the overall incidence rose from 1973 through 1995 (from 2.3 to 3.1 per 100,000), with the greatest increase occurring from 1983 through 1986. A recent publication, in the September 2, 1998, issue of the *Journal of the National Cancer Institute* suggests that this rise may not represent a true increase in the number of cases, but may be due to better diagnosis using magnetic resonance imaging, a technique that produces images of the brain using a powerful magnet linked to a computer. This technology came into widespread use in the mid-1980s.

The causes of childhood cancers are largely unknown. A few conditions, such as Down's syndrome, other specific chromosomal and genetic abnormalities, and therapeutic doses of radiation, explain a small percentage of cases.

Environmental causes of childhood cancer have long been suspected by many scientists, but have been difficult to pin down, partly because cancer in children is rare and partly because it is so difficult to estimate past exposure levels in children after they develop cancer. The rarity of childhood cancer prevents investigators from following healthy children until they develop cancer, since millions of children would need to be followed in order to accurately assess exposure prior to diagnosis, rather than afterward. In addition, each of the distinctive types of

childhood cancers develops differently—with a potentially wide variety of causes and a unique clinical course in terms of age, race, gender, and many other factors.

Cancer Clusters

A cancer cluster occurs when the number of cancer cases within a geographic area, a particular group of people, or a certain period of time is greater than expected. State/local health departments are responsible for conducting cancer cluster studies and are the agencies to which a suspected cluster should be reported. It is not uncommon for the initial evaluation of a suspected cluster to reveal that the number of cancer cases is not substantially different from the expected pattern in number, type, or age of the cases. More comprehensive evaluations are generally conducted when the state/local health department determines that the pattern of cancer cases is unusual or when the aggregation of cases is associated with a possible source of exposure (e.g., a hazardous waste site or contaminated groundwater).

Results from Recent Studies Supported by the National Cancer Institute

For several decades the National Cancer Institute (NCI) has supported national and international collaborations devoted to studying causes of cancer in children. Some of the key findings from recent studies include:

- Low levels of radiation exposure from radon were not significantly associated with childhood leukemias.
- Residential magnetic field exposure from power lines was not significantly associated with childhood leukemias.
- High levels of ionizing radiation and specific genetic syndromes have been linked with increased risk of specific childhood cancers.

- Little evidence has been found to link specific viruses or other infectious agents with the development of most types of childhood cancers.
- No consistent findings have been observed linking the occupational exposures of parents to the development of childhood cancers.
- Children whose mothers had diagnostic X-rays during pregnancy were previously found to have consistently increased risks for leukemia and other childhood cancers, but recent studies suggest that this relationship is no longer evident because few mothers now receive diagnostic X-rays during pregnancy.
- Ultrasound use during pregnancy has not been linked with childhood cancer in numerous large studies.
- Children treated for Hodgkin's disease with chemotherapy and radiation therapy have elevated risks of second primary malignancies.
- Children receiving high dosages of topoisomerase inhibitors to treat their primary cancer appear to be at higher risk of developing secondary acute myeloid leukemias.
- Several studies have found no link between maternal cigarette smoking before pregnancy and childhood cancers, but increased risks were related to the father's prenatal smoking habits in studies in the United Kingdom and China.

NCI's Current Research on Causes of Childhood Cancer

NCI is currently funding a large portfolio of studies looking at the role played by genetic factors, medical conditions, and environmental exposures of parents or children in the development of childhood cancers. Ongoing investigations include:

- Cooperative Children's Cancer Group study evaluating several potential risk factors for childhood acute lymphocytic leukemia. Factors under investigation include inherited or random genetic mutations; exposures to infectious agents; parental occupational exposures to radiation or chemicals; parental medical conditions during pregnancy or before conception; and parental, fetal, or childhood exposures to environmental toxins such as pesticides, solvents, or other household chemicals.
- Evaluation of effects of ionizing radiation exposures on the development of childhood cancers.

- Studies examining the role of viruses or other infectious agents in the development of childhood cancers. These involve looking at the infectious disease history of the family, enrollment in day care, blood transfusions, exposures to pets and farm animals, and vaccinations.
- The role of maternal exposures to oral contraceptives, fertility drugs, and diethylstilbestrol (DES) in several ongoing studies.
- Role of familial and genetic disorders in development of childhood cancers.
- The cancer risk of HIV-infected children.

NCI's Future Investments

- NCI-supported studies are currently enrolling approximately 15,000 long-term childhood cancer survivors to obtain accurate estimates of second cancer risks associated with chemotherapy and radiation.
- A monograph based on data from the NCI's Surveillance, Epidemiology, and End Results (SEER) Program will be published in 1999 on U.S. trends in incidence, mortality, and survival rates of childhood cancers.
- A Pediatric Brain Tumor Clinical Trials Consortium, a group of institutions with exceptional multidisciplinary expertise, will support innovative brain tumor clinical research. Clinical trials are expected to begin by the end of 1999. This consortium will also include the latest data management systems and communications infrastructure.
- A National Network for Research on Causes of Cancer in Children will create a national registry of children with cancer, including a tissue bank for tumor and blood specimens, to be used for identifying environmental and other causes of childhood cancer. This initiative will build on the unique national clinical trials system for treating children with cancer. Funding is expected to begin in the year 2000.

NCI's Overall Research Program for Children with Cancer

NCI funding for research on cancer in children is estimated at \$85 million in 1999. These funds support the NCI's overall research activities relating to childhood cancer, including:

- Studies to identify causes of the cancers that develop in children;
- Monitoring of U.S. and international trends in incidence and mortality rates for childhood cancers;

- Studies to better understand the biology of childhood cancer, with the hope that this understanding will lead to new treatment approaches that target critical cellular processes required for cancer cell growth and survival;
- Projects to identify health outcomes of survivors of childhood cancer in order to improve the health status of survivors;
- Evaluations of new drugs that may be more effective against childhood cancers and that may have less toxicity for children; and
- Clinical trials to identify superior treatments for childhood cancers, thereby leading to improved survival rates for children with cancer. In 1998, NCI sponsored over 80 clinical trials for children with cancer. Approximately 5,000 children enter into NCI-sponsored clinical trials each year.

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Sources of National Cancer Institute Information

Cancer Information Service

Toll-free: 1-800-4-CANCER (1-800-422-6237)

TTY: 1-800-332-8615

NCI Online

Internet

Use <http://www.cancer.gov> to reach NCI's Web site.

CancerMail Service

To obtain a contents list, send e-mail to cancermail@icicc.nci.nih.gov with the word "help" in the body of the message.

CancerFax® fax on demand service

Dial 301-402-5874 and listen to recorded instructions.

The most recent data for childhood cancer incidence, mortality, and survival rates are available in the "SEER Cancer Statistics Review, 1973-1995," which can be found in the publications section of the SEER Web site at <http://www-seer.ims.nci.nih.gov/Publications/> on the Internet.

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